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Dynamically Close Pairs of Galaxies Selected in the NIR

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Abstract. Studies of dynamically close pairs of galaxies can serve as a powerful probe of the galaxy merger rate and its evolution. Here we present a large sample of dynamically close pairs of galaxies selected in the $K-$band from the UKIDSS LAS. These data span ~ 175 deg^2 on the sky in the 2dFGRS equatorial region ($10^h < \mathrm{RA} < 14^\mathrm{h}$). Combining the 2dFGRS redshifts with those from the SDSS, our $K-$band selected catalog is $> 90\%$ spectroscopically complete at $K_{\mathrm{AB}} < 16.4$. In this study, we focus on quantifying the relative contributions of wet, dry, and mixed mergers to the stellar mass buildup of galaxies over the past $1 - 2$ Gyr.

Keywords. Galaxies, Mergers, Near-Infrared

Synopsis: The galaxy merger rate and its evolution are important quantities for theories of galaxy formation. In hierarchical ΛCDM models, galaxies are expected to accrete most of their stellar mass via mergers, with at least 50% of the total stellar mass growth occurring at $z < 1$. Mergers should have a profound influence on galaxy properties such as morphology, star formation rate, and nuclear activity, among others.

Mergers are often categorized into three types: "wet", "dry", and "mixed". These labels describe whether the galaxies involved are star-forming, and contain significant cold gas, or are passively evolving. Wet mergers involve two galaxies that are actively forming stars and contain significant reservoirs of cold gas. Wet mergers are expected to trigger additional star formation, and potentially nuclear activity as well. On the contrary, in "dry" mergers both galaxies are passively evolving and contain little cold gas. Dry mergers are not expected to enhance star formation in the remnant. A "mixed" merger is one in which a star-forming galaxy with cold gas merges with a passive galaxy.

Of critical importance to understanding the stellar mass assembly of galaxies is what fraction of mergers trigger enhanced star formation. As noted above, roughly 50% of the stellar mass growth of galaxies takes place at $z < 1$. During the same epoch, the star formation rate density is declining dramatically, and thus, dry mergers must play an increasingly important role in the stellar mass buildup of galaxies over the last half of the age of the universe.

In our sample, we find a similar total merger rate ($\sim 1.5\%$) to $K-$band selected samples at lower redshifts. However, we find that the majority of the pairs in our sample are dry merger candidates, nearly a factor of three higher than the fraction (25%) found by other studies at $z \sim 0.1$. Some of this discrepancy could come from the fact that other groups have performed optical selections, while ours is in the NIR, or from a difference in classifying "blue" vs. "red" galaxies. In a forthcoming series of papers we will present a detailed study of stellar mass assembly of galaxies inferred from our dynamically close pair sample.